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Peri-Urban Household Willingness to Pay for Safe Drinking Water: A Case Study of Ijebu North East Local Government, Ogun State

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ABSTRACT: Water covers three quarters of the earth surface although only about one percent is available to humans as drinking water. But reliable and sufficient supply of safe water is one of the basic needs of all mankind. This project explores peri urban household's behavior on willingness to pay for safe drinking water by surveying and analyzing 120 peri urban households in Ijebu North East Local Government Area. Descriptive statistics was used to analyze household socio-economic characteristics. A classical method was employed, contingent valuation method. The binary logit was used to estimate household decision of paying or not paying for safe drinking water. In all, about half of the household have piped water as their major source of drinking water out of the four categories (piped, well, bottled and sachet water). The household's decision to pay for tap water was tested at 5 percent and years of schooling, gender, average monthly income and marital status were found to be significant. The results also shows that the household decision to pay for sachet water significantly depends on major source of water, household contribution to water project, number of taps and current water services. Meanwhile number of household member below SSCE and household monthly income are strong factors influencing household's willingness to pay for bottled water. This study recommends boosting educational system through encouraging the masses on the long term effect of been educated via media houses as well as government making education affordable through funds amongst others.

Keywords: peri urban, willingness to pay, safe drinking water

1. Introduction

Water is a natural resource of fundamental importance. Water is essential for agricultural, household, industrial, tourism, and cultural purposes and sustenance of the ecosystem (Mark et al. 2002[1]; Oloruntade et al. 2012[2]; Sriyana et al. 2020[3]).

In rural Africa, women are mostly burdened with water collection whereby inadequate water supply makes women and children to trek long distances every day for water collection. The alternative is the collection of water from rivers, streams and ponds, which may contain pathogens that might still be lesser farther (WHO/UNICEF, 2013[4]; Grahams et al., 2016[5]).

Despite women and children having to trek long distances, There is an abundant fresh water resource in Nigeria, predominantly in the south-western region of the country (Obatoyinbo and Oyedotun, 2011)[6]. However, a recent report by the United Nations Development Programme (UNDP) Human Development Index

placed Nigeria 159 among 177 countries assessed for unavailability of safe water and also among the 30 nations with poorest quality of life worldwide (Ifabiyi, 2012)[7].

In Nigeria, less than one-third of urban and rural dwellers have access to piped water supply connections in their yards (WHO/UNICEF, 2014[8]). The Limited access to safe water have adversely affected millions of people in the world most especially the poor in that they die from preventable diseases caused by inadequate water supply (Weststrate et al., 2018[9]).

Water demand becomes necessary as the urban population dependent on public water supplies increases rapidly and new demands for water are not easily met. Successive Nigerian governments have been pursuing with vigor aggressive water supply programs and donor agencies also have been making their impacts in the sector through expansion of water supply infrastructures. Despite these efforts the public are still disenchanted because access to safe water and sanitation is not improving (Emoabino and Alayande. 2007[10]).

Attention has been on the increase in recent years concerning peri-urban development (Anthrop, 2000[11]; Wiggens and Proctor 2001[12]; Maconachie and Binns 2006[13]; Qviström, 2007[14]). Of note is, Anthrop (2000[11]) and Ode and Fry (2006)[15] that describe the peri-urban areas as those areas adjacent to built-up areas of high population concentrations (that is, urban), they specified that they are the zones where traditional farming activities come into conflict with alternative economic, residential and recreational interests.

Many factors affect household water demand and willingness to pay for improved water services even in peri urban areas. According to a World Bank (1992)[16] many of the water projects implemented over the last decades in developing countries are considered as failures. This is due to poor knowledge of the health benefits of improved water supplies, affordability of tariffs, insensitivity by donors and central government to local customs and beliefs and the ability to operate and maintain water systems by local :and community participation and; local involvement in design and management (Brookshire and Whittington, 1993)[17]. Emphasizing the importance of water, Nielson (2004)[18] contends that safe drinking water is not just a luxury. It often makes the difference between life and death.

Meanwhile over the years, studies have shown that shortages of clean water are associated with improper management, alarming population growth, unfavorable policy implementation of water-related projects and upsurge in industrial activities (Sibanda et al., 2014[19]; Kora et al., 2017[20]). There is need for urgent interventions to prevent water shortages, particularly in developing countries like Nigeria(in urban, rural and peri urban areas) where significant reports of waterborne infections and diseases such as diarrhea, cholera and typhoid occur as a consequence of poor sanitation and poverty (Coleman et al., 2013[21]; Igbinosa and Aighewi, 2017[22]).

Many studies on willingness to pay for water have been undertaken on both urban and rural households. Aminu, and Nyor 2021[23], analyses willingness to pay for improved water supply among rural households in Benue state, Nigeria while Coster, and Otufale, G. A. 2014[24] estimates Households' water-use demand and willingness to pay for improved water services in Ijebu Ode, Nigeria amongst others.

What remains understudied is the crisis of peri-urban water dynamics/ willingness to pay; it is poorly understood when compared to the urban-rural trans-boundary governance dynamics. It is thus of great importance to understand the safe drinking water supply situation of peri urban households and their perception. Hence this study which identifies the different households sources of safe drinking water available and their willingness to pay for safe drinking water.

2. Materials and Methodology

Contingent valuation method (CVM) is a questionnaire based valuation technique whereby willingness to pay (WTP) will be directly obtained from the respondents with respect to a specific good. As such the technique that used is the open ended question method which produces a continuous bid variable and may therefore be analyzed using standard statistical techniques.

Basically two theoretical approaches (the direct and indirect) are used for making reliable estimates of Household WTP for improvement in service and quality of water [Abdullah, et al. (1992)[25]

The direct approach uses stated preference in which simply the individuals are directly asked how much he/she would be willing to pay for the improved water service. This is called contingent valuation method (CVM). The method is used to estimate economic values for all types of environmental goods and services (use and non-use values).

(ii) The indirect approach uses data on observed water use behavior (revealed reference) for averting the effects of inefficient and unsafe water qualities to estimate WTP.
To survive the issue, consumers develop various coping strategies. The coping cost give an estimate of how much additional money people are willing to pay for an improved quality.

In this paper, basically, direct approach is-used in this study for making reliable estimates of households' WTP for improvement in service and quality of water. Contingent valuation method (CVM), the approach uses stated preference simply directly ask individual how much he or she would be willing to pay for the better water services.

CV is usually the only feasible method for including passive use considerations in an economic analysis, a practice that has engendered considerable controversy. CVM surveys should carefully describe both quality levels and ask for respondent willingness to pay for the change in quality [Mitchell, et al. (1989)][26].

2.1 Model Specification for Willingness to Pay for Potable Water

The logit model was used to determine the willingness to pay for potable water by households. Binary logit regression can help to identify internal and external factors influencing the decision of whether or not to pay for safe drinking water. Consumers want to maximize his utility from quantity and quality of goods and services given his budget constraint.

The utility function U (q, z)

q = water quality
z = composite of all market goods

The expenditure function (p, q, u)

The expenditure function measures the minimum amount of money the consumer must spent to achieve the given level of utility. The expenditure function is increasing function of 'p' and 'U' and decreasing function of 'q'. Since consumer want to stay with the same utility, it is appropriate to use expenditure minimization problem.
:Min (z + pz) s. t U (q, z)(1) where price of composite goods ware equal to obtain Hicksian demand for the compounding goods.

The Hicksian demand is given by;

:hi = hi(pq, u*)(2)
Minimum expenditure function can be calculated by substituting the values of
Corresponding Hicksian demand in the minimum expenditure function:
:e* = e (p, q, u*)(3)
Where e is minimum expenditure required to achieve fixed level of utility u* and using the water quality q, and is the function of price of other goods, the fixed level utility and the quality of the water itself. The derivative

of expenditure function with respect to price gives corresponding Hicks Compensated demand function for good consideration: ∂e/∂pi = hi (pq, u*)(4)

So, to capture various determinants of WTP the following multivariate regression analysis is conducted.
WTPi = β0 (Hi) + β2 (D) + β3 (Si) + ui (5)
Where:
WTPi = Household's willingness for potable water supplies,
Hi = Households characteristics (Highest education level of the household, income level of the household)
Di = Households demographic characteristics (peri-urban)
Si = Service characteristics [time taken for fetching water, tap, well]
Hii = Households characteristics
H1 = Age in Years (household head)
H2 = Marital status
H3 = Household size (in number)
H4 = Highest educational attainment (1, if tertiary, 0, otherwise)
H5 = Occupation (1, government employee, 0, otherwise)
H6 = Average monthly income (naira)
Si = Service Attribute
S1 = Water supply service (1 if good, 0, otherwise)
S2 = Quantity of water in Litres
S3 = Reliability of the source (1, if good, 0, otherwise)
S4 = Collection time in minute
S5 = Distance to the source in kilometers
S6 = Latest water shortage (min/hrs/dys)
S5 = Price of water in naira

3. Result

This chapter deals with the presentation of data collected from the respondents and results of analysis.

3.1. Gender of Respondents

The gender of respondents from Table 1 below shows that 51.7 percent are Female respondents' household heads and 48.3 percent males.

Table 1: Distribution of Respondents by Gender

Sex	Frequency	Percent	Cumulative Percent
Female	62	51.7	51.7
Male	58	48.3	100.0
Total	**120**	**100.0**	

Source: Field Survey 2019

3.2 Age of Respondents

The distribution of respondents by age in Table 2 below shows that 31.7% are between ages 40-49 years and 10.8% are below age 20. The mean age of the respondents is 43 years. This result shows that ages 40-49 are the most active age.

Table 2: Distribution of Respondents by Age

Age	Frequency	Percent	Cumulative Percent
Less than 20	13	10.8	10.8
20-29 yrs	16	13.3	24.2
30-39 yrs	30	25.0	492
40-49	38	31.7	80.8
50 and above	23	19.2	100.0
Total	**120**	**100.**	

Source: Field Survey 2019

3.3 Marital Status

The result of the analysis shows that 47.5% of the respondents are single, 51.7% are married while 0.8 % are divorced from Table 3.

Table 3: Distribution of Marital Status of respondents

Marital Status	Frequency	Percent	Cumulative Percent
Single	57	47.5	47.5
Married	62	51.7	99.2
Divorced	1	0.8	100.0
Total	120	100.0	

Source: Field Survey 2019

3.4 Distribution of Respondents by Number in Household

Table 4 below shows that in every household , 75.8% of them have between 1-3 adults while 3.3% have more than 6 adults.

Table 4: Distribution of Respondents by Number of Adults in Household

No of Adults	Frequency	Percent	Cumulative Percent
1-3 adult	91	75.8	75.8
4-6 adult	25	20.8	96.7
Above 6 adult	4	3.3	100.0
Total	**120**	**100.0**	

Source: Field Survey 2019

3.5 Distribution of Respondents by Number of Children in Household

Table 5 shows that; 56.7% have 1-3 children, 23.3% have 4-6 children while 1.7% has above 6 children. This shows that most households have 1-3 and the least is above 6 children.

Table 5: Distribution of Respondents by Number of Children in Household

No of Children	Frequency	Percent	Cumulative Percent
0 children	22	18.3	18.3
1-3 children	68	56.7	75.0
4-6 children	28	23.3	98.3
Above 6 children	2	1.7	100.0
Total	**120**	**100.0**	

Source: Field Survey 2019

3.6 Highest Education Level

Table 6 below shows the distribution of respondent by highest level of education attained. Those with University education have the highest teachers training college education with 11.7% those that possess primary education, professional education and others are 10.8%, 8.3% and 1.7% respectively. This shows that a higher percentage of the respondents are literate.

Table 6. Distribution of Respondents by Highest Education Level

Education level	Frequency	Percent	Cumulative Percent
Primary sch	13	10.8	10.8
Secondary sch	36	30	40.8
Teachers training	14	11.7	52.5
Professional school	10	8.3	60.8
University	45	37.5	98.3
Others	2	1.7	100.0
Total	**120**	**100.0**	

Source: Field Survey 2019

3.7 Occupation of Respondents

The result of the analysis in table 7 shows that majority of the respondents are into the teaching profession (24%), these are followed closely by those involved in trading of all sorts with 22.5% civil servants are also predominant in the are having 15% of the total percentage. Farming and tailoring have the percentage 8.3%; this shows that farming in the area of not prevalent based on little expanse of land available for agriculture. Those involved in fishing activity are few (0.8%). Handwork like hairdressing, mechanics are 5.0% and 4.2% respectively. The people also involved in menial jobs (hired labor) are 4.2%. The respondents involved in Professional work like nursing are 1.7% while those involved in other occupations are 5.8%. This shows that the households have several sources of income to meet their needs.

Table 7: Distribution of Respondents by Occupation

Occupation	Frequency	Percent	Cumulative Percent
Fishing	1	0.8	0.8
Farming	10	8.3	9.2
Nursing	2	1.7	10.8
Hired labor	5	4.2	15.0
Mechanic	5	4.2	19.2
Tailoring	10	8.3	27.5
Hair dressing	6	5.0	32.5
Trading	27	22.5	55.0
Teaching	29	24.2	79.2
Civil Servant	18	15.0	94.2
Others	7	5.8	100.0
Total	**120**	**100.0**	

Source: Field Survey 2019

3.8 House Ownership

The result of the analysis below shows the distribution of the type of respondent's house ownership in Table 8. About 43.3% are private house owners while 32.4% live in public houses, 24.2% live in semi-public houses i.e. they are not paying for the house neither are they owner of the house they stay (e.g family houses)

Table 8: Distribution of Households by Ownership Type

House ownership	Frequency	Percent	Cumulative Percent
Public	39	32.5	32.5
Semi public	29	24.2	56.7
Private	52	43.3	100.0
Total	**120**	**100.0**	

Source: Field Survey 2019

3.9 Household with Tap

The result of the analysis reveals that 69.2% of the household have tap running in their house while 30.8% do not have tap running.

Table 9: Distribution of Households with Tap Running

House ownership	Frequency	Percent	Cumulative Percent
Presence of tap water	83	69.2	69.2
Absent	37	30.8	100.0
Total	**120**	**100.0**	

Source: Field Survey 2019

3.10 Major Household Source of Drinking Water

Table 3.10 below shows that 48.3% of the household have piped water as their major source of drinking water.10.8% use well water, 11.7% used bottled water and 29.2% of the total household used sachet water as their major source of drinking water. The result shows that the major source of drinking water in the area is piped water, followed by sachet water, bottled water, well water in that order.

Table 10: Distribution of Households by Major Source of Drinking Water

Source of water	Frequency	Percent	Cumulative Percent
Piped water	58	48.3	48.3
Well water	13	10.8	59.2
Bottled water	14	11.7	70.8
Sachet water	35	29.2	100
Total	**120**	**100.0**	

Source: Field Survey 2019

3.11 Drinking Water in Liters

Table 11 shows the liters of drinking water consumed by household on daily basis. About 36.7% the household consume 11-15 litres of water per day. About 27.5% consumes 6-10liters per day. About 15.8% each, for 1-5 and 16-20 liters of drinking water per day. The remaining 4.2% consume above 20 liters of water daily.

Table 11: Distribution of Households by Consumption of Drinking Water in Litres

Water consumption per day	Frequency	Percent	Cumulative Percent
1-5 liters	19	15.8	15.8
6-10 liters	33	27.5	43.3
11-15 liters	44	36.7	80.0
16-20 liters	19	15.8	95.8
Above 20 litres	5	4.2	100.00
Total	**120**	**100.0**	

Source: Field Survey 2019

3.13 Water Purification Method

The respondent in the study area feel that the quality they are receiving is not safe and resultantly they adopt certain measures for the safety of water. Water purification method of the household is shown in table 12 below which shows that 54.2% of the household uses boiling method in purifying their water while 8.3% used filtration method of water purification.

Table 12: Distribution of Respondents from Household by Water Purification Method

Water purification method	Frequency	Percent	Cumulative Percent
Boiling	65	54.2	54.2
Adding alum	32	26.7	80.9
Filtrations	10	8.3	89.2
Others	13	10.8	100.0
Total	**120**	**100.0**	

Source: Field Survey 2019

3.14 Determinants of Willingness to Pay for Tap Water

The marginal effect of the logit model estimates the factors that determine the household willingness to pay for tap water and this is presented in Table 13 below. This shows the magnitude by which the probability of household willingness to pay for tap water will increase by a unit change in the independent variable. The significant variables in the model are years of schooling, house ownership, gender, average monthly income and marital status.

Years of Schooling: It has a positive sign, marginal effect of 0.660 and significant at 5 percent. The result of the analysis shows that a unit increase in years of schooling will increase the probability of the household willingness to pay by 66% Similar results are found in Simiret Wendimu (2011)[27], education level of the respondent is a significant variable that can explain the decision on WTP.

House Ownership: house ownership has a negative sign and marginal effect of 0.350; this is significant at 10 percent level of significance. The result shows that a unit increase in private house ownership reduces the household willingness to pay for tap water by 33.

Gender: This has a positive sign, marginal effect of 0.445. It is significant at 5 percent level of significant. Atlaf et.al. 1993[28], showed that gender was also statistically significant in WTP. The more female we have in the study area, the more willing they are to pay for tap water.

Average Monthly Income: Average monthly income has a positive sign, a marginal effect of 0.284, and it is significant at I percent level of significance. This shows that a unit increase in the household average monthly income increases the household willingness to pay for top water by 28 percent.

Marital status: This has a positive sign, a marginal effect of 0.459, and it is significant at 5 percent level of significance. This shows that marital status has an increasing effect on the household willingness to pay for tap water. The more married people we have the more willingness to pay for tap water

Table 13: Marginal effect after logit (tap water wtp)

Variable	Marginal effect	Standard error	p>z
Maximum expense	-0.023	0.266	0.929
Major source of water	-0.193	0.197	0.322
Highest level of education	-0.249	0.212	0.235
Years of school	0.0660	0.145	0.024**
Above ssce	0.186	0.267	0.461
House ownership	-0330	0.175	0.090*
Days per week, tap	-0.083	0.118	0.483
Gender	0.445	0.155	0.011**
Average monthly income	0.284	0.096	0.005***
Marital status	0.459	0.164	0.018**

Number of observation = 59
L.R chi2(10) = 27.67
Prob chi 2 = 0.0020
Pseudo R2 = 0.3550
Log likelihood = 25.132723

****Significant at 1% of significance, **Significant at 5% level of significance* Significant at 10% level of significance.*

Source: Data analysis, 2019

3.15 Determinants of Willingness to Pay for Sachet Water

Household major source of drinking water: The household major source of drinking water has a negative sign, a marginal effect of 0.283 and significant at 5 percent level of significance. The result shows that more households are satisfied with the existing water source and this made them to have lesser willingness to pay for sachet water.

Contribution to Water Sustenance Project: this has a negative sign, a marginal effect of 0.264 and significant at 10 percent level of significance. This shows that a unit increase in number of household that are willing to contribute to water sustenance project leads to a decrease in the household willingness to pay for sachet water with 26 percent.

Number of Taps: Number of taps has a negative sign, a marginal effect of 0.143 and significant at 10 percent level of significant. The result shows that a unit increase in the number of taps in the area reduces the household willingness to pay for sachet. Similar results are found in

Current Water Service: This has a negative sign, a marginal effect of 0.698 and significant at 1percent of level of significant. The result shows that an increase in the current water service reduces the household willingness to pay for sachet water by 69%

Highest Education level: Highest education level dummy is positive with a marginal effect of 0.379, and is significant at 5 percent level of significance. The result shows that the highest education attained by the household increases the household willingness to pay for sachet water by 37%. It is believed that a person is more informed about different key sectors of the community and the world at large when he/she is educated (Galgalo & Aga 2019)[29].

Average Monthly Income: This has a positive sign, a marginal effect of 0.129 and its Significant at 10% level of significance. The result shows that a unit increase in the household monthly income increases the households willingness to pay for sachet water by 12,9%. Asante et.al. (2002)[30] established a relationship between household income and willingness to pay for water.

Table 14 : Marginal effect after logit (WTP sachet)

Variables	Marginal effect	Standard error	p>z
Major sources of water	-0.283	0.128	0.047**
If contribution will you	-0.264	0.161	0.089*
Government subsidy	0.148	0.101	0.239
Number of taps	-0.143	0.081	0.095*
Current water services	-0.698	0.176	0.004***
Tap running in household	0.172	0.115	0.172
Drinking water in litres	0.136	0.101	0.341
House ownership	-0.058	0.111	0.617
Highest education level	0.379	0.157	0.022**
Average monthly income	0.129	0.070	0.067
Any disease	0.186	0.126	0.164

Number of observation = 73
L.R chi2 (11) = 31.41
Prob chi 2 = 0.0009
Pseydo R2 = 0.3664
Log likelihood = 25.132

****Significant at 1% of significance, **Significant at 5% level of significance* Significant at 10% level of significance.*

Source: Data analysis, 2019

3.16 Determinants of Willingness to Pay for Bottled Water

Below SSCE: This has a negative sign, a marginal effect of 0.795, and is significant at 10 percent level of significance. This result shows that a unit increase in the household below SSCE reduces the household willingness to pay for bottled water by 79.5%.

Average Monthly Income: this has a negative sign, a marginal effect of 0.634, and is significant at 10 percent level of significant. The result shows that a unit increase in the household monthly income reduces the household willingness to pay for bottled water by 63.4%. This shows that people's WTP is not influenced directly by their income levels. This may be due to having own source of drinking water and low level of education.

Table 15 Marginal Effects after logit (Bottled Water WTP)

Variables	Marginal effect	Standard error	p>z
Below SSCE	-0.795	0.265	0.079
Drinking water in liters	0.443	0.365	0.165
Highest education level	0.504	0.440	0.261
Last period	0.349	0.239	0.131
House ownership	-0.508	0.401	0.197
Days per week, tap	0.326	0.255	0.116
Average monthly income	-0.634	0.0312	0.065*

Number of observation = 34
L.R chi2 (11) = 28
Prob chi 2 = 0.0002
Pseydo R2 = 0.6342
Log likelihood = 8.0752351
****Significant at 1% of significance, **Significant at 5% level of significance* Significant at 10% level of significance.*

Source: Data analysis, 2019

4. Conclusion

The research work has examined the various sources of water available in the study area (Ijebu North East) and their willingness to pay for sales drinking water and the study revealed that the major sources of drinking water is piped water but for the long queue that characterize it. In the area, household do choose bottled water because of exposure to water borne disease. Meanwhile, education level and the household monthly income increase the willingness to pay for tap and sachet water in the area

Based on the findings, the following recommendations are made:

Years of schooling and household monthly income has a positive relationship with willingness to pay for tap/piped water as well as sachet water. Boosting educational system through encouraging the masses on the long term effect of been education via media houses is encouraged and government making education affordable through funds goes a long way.

Also, the government in relation with policy makers to put in place policies that increases the welfare of individuals through government welfare and empowerment scheme increases household income and in turn will have positive effect on the household consumption of safe drinking water.

The number of piped water is at reduced rate because household still go for well water to avoid queuing. It is therefore recommended that more public taps should be constructed by government and private investors for easy availability of safe drinking water.

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